Construction Analysis for Pavement Rehabilitation Strategies

Software Integration of Design, Construction, and Traffic for Accelerated Highway Rehabilitation Projects

State transportation agencies are increasingly shifting their focus from constructing new highways to rehabilitating and reconstructing existing facilities. Because highway rehabilitation projects often cause congestion, safety problems, and limited access for road users, agencies face a challenge in finding economical ways to rehabilitate deteriorating roadways in metropolitan areas while keeping the traveling public as safe as possible and minimizing disruptions for local communities and surrounding businesses.

One innovation in the effort to reduce highway construction time and its impact on traffic is software called *CA4PRS,* Construction Analysis for Pavement Rehabilitation Strategies. *CA4PRS* is a schedule and traffic analysis tool that helps planners and designers select effective, economical rehabilitation strategies. Funded through an FHWA (Federal Highway Administration) pooled-fund, multistate consortium (California, Minnesota, Texas, and Washington), *CA4PRS* was developed by the University of California Pavement Research Center (UCPRC) through the UC Berkeley Institute of Transportation Studies.

The software's scheduling module estimates highway project duration (total number of closures), incorporating alternative strategies for pavement designs, lane-closure tactics, and contractor logistics. *CA4PRS's* traffic module (using the Highway Capacity Manual demand capacity model) quantifies the impact of construction work zone closures on the traveling public in terms of road user cost and time spent in queue.

Benefits of *CA4PRS*

Demonstrations have shown that *CA4PRS* is user-friendly, easy to learn, and valuable in any project phase. Its greatest value lies in its capability to provide information to the planner/designer to optimally balance pavement design, construction constraints, traffic operations, and agency budget for transportation agencies — especially during the planning and design of rehabilitation projects. *CA4PRS* yields additional benefits when its results are integrated with various traffic simulation modeling tools in quantifying the impact of work zone lane closures to the whole highway network, including local arterials and neighboring freeways.

CA4PRS helps agencies, contractors, and consultants prepare strategies (including the PS&E package) for highway projects by:

- Estimating working days and CPM schedules,
- Developing construction staging plans,
- Supplementing traffic management plans, and
- Outlining incentives and cost (A) + schedule (B) contracts.

Implementation Experience

Since 1999, the capabilities of *CA4PRS* have been confirmed on several major highway rehabilitation projects in states including California, Washington, and Minnesota. The software was validated on the 2.8-lane-km I-10 Pomona Project, which used fast-setting hydraulic cement concrete and was completed in one 55-hour weekend closure. The software was also used to develop a construction staging plan for the I-710 Long Beach Project, where 26 lane-km of asphalt concrete were reconstructed in a series of eight 55-hour weekend closures—two weekends ahead of schedule.

More recently, *CA4PRS* was used with traffic simulation models to select the most economical rehabilitation scenario for the I-15 Devore Project (see table on the next page). The 4.5-km concrete reconstruction project, which would have

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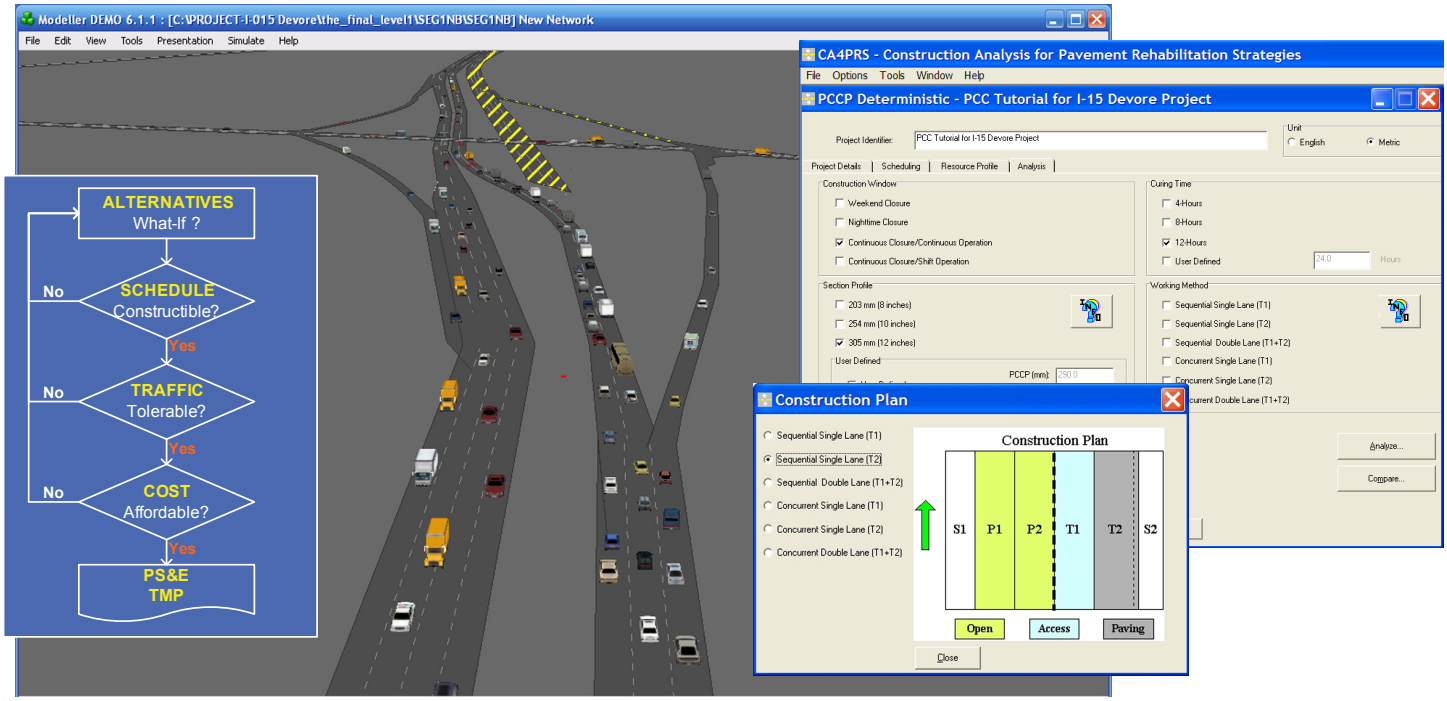

Shown above: the CA4PRS framework (left), user interface (right), and microscopic traffic simulation (center).

taken 10 months using traditional nighttime closures, was completed over two 9-day periods using one-roadbed continuous closures and around-the-clock construction. Implementing continuous closures rather than repeated nighttime closures in this project resulted in significant savings: $6 million in agency costs and $2 million in road user costs. Alternative strategies enabled by use of *CA4PRS* led to an accelerated project process dubbed "Rapid Rehab" that was praised by professionals.

Other sponsoring state transportation departments have also used *CA4PRS* for analyses of corridor rehabilitations. The Washington State DOT used it to analyze reconstruction of Interstate 5 through Seattle. The Minnesota DOT used it to analyze the rehabilitation of interstates 394 and 494 in St. Paul.

C4PRS software justified implementing the one-roadbed continuous closure scenario on the I-15 Devore Project.

Construction Alternative	Schedule Comparison		Cost Comparison ($M)			Max. Delay (Min.)
	Total Closures	Closure Hours	User Delay	Agency Cost	Total Cost	
Continuous (24/7) Closure	2	400	5.0	15.0	20.0	80
72-Hour Weekday Closure	8	512	5.0	16.0	21.0	50
55-Hour Weekend Closure	14	770	14.0	17.0	31.0	80
10-Hour Night-time Closure	220	2,200	7.0	21.0	28.0	30

Nationwide Outreach

Throughout the U.S. there is growing recognition of the capabilities and benefits of *CA4PRS*. It has been presented at national conferences and workshops hosted by the TRB, AASHTO, and FHWA; and articles about it have been published in professional journals (including ASCE and TRR), transportation magazines such as *TR News, FOCUS,* and *Public Roads,* and industry (ACPA and NAPA) newsletters.

To boost nationwide deployment, FHWA is in the process of arranging free group licenses for all fifty states. FHWA encourages use of *CA4PRS* for highway rehabilitation projects by conducting workshops and training sessions through the National Highway Institute (NHI). AASHTO also endorses wider use of the software. The AASHTO Technology Implementation Group (TIG) is focusing on *CA4PRS* for nationwide promotion to its state members, and is in the process of establishing a campaign to market the software in the *AASHTOWare* product line.

CA4PRS training is being provided to end users, mainly focusing on the states contributing to the pooled fund. Over the last five years, about 600 transportation engineers have attended two-day intensive (hands-on) training workshops conducted by the Principal Investigator for *CA4PRS* development, Dr. E.B. Lee.

For More Information

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